Small Business Innovation Research/Small Business Tech Transfer

High-Efficiency Data-Rate-Scalable Laser Transmitter for Interplanetary Optical Communications, Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

Interplanetary missions are at the core of NASA's current space exploration program and are expected to lead the way to new resource discovery in the next decade and beyond. In the absence of manned craft, the payoff for a given mission rests in its ability to gather data and transmit it back to Earth. While sensors and metrology instrumentation are continually being improved with emergent subsystems, the bottleneck to mapping the solar system rests not with the ability to gather data, but rather to transmit it back to Earth. Current deep-space missions rely on radio communications, while optical communications utilize laser transmitters with carrier frequencies around 200 THz for the most mature 1550-nm band. Although the optical bandwidth is substantially larger than radio communications, the required energy at the receivers currently limit the data rates to 300 Mbps, similar to that achievable with radio communications systems. However, the true value of optical communications lies in the directionality of the laser beam - the radiated energy is not wasted into a large portion of the hemisphere but transported to the intended receiver. While many companies currently offer telecommunications-band amplifiers, none meet the exacting needs of NASA's space-com mission such as high efficiency, power, and dedicated (low) data rates. In this proposal, we propose the development of a qualitatively novel approach to high-power, low-bit-rate laser transmitters compatible with deep-space missions. Specifically, we propose to develop a master-oscillator/power amplifier (MOPA) system using two innovative and unique amplifier modules. The new transmitter device possesses both high efficiency (> 20% electrical-to-optical) and low SWaP footprint. The new transmitter can operate at 20W average power at arbitrary data rates and generate any symbol format, enabling both local (Martian-like) and deep-space (interplanetary) communications missions.

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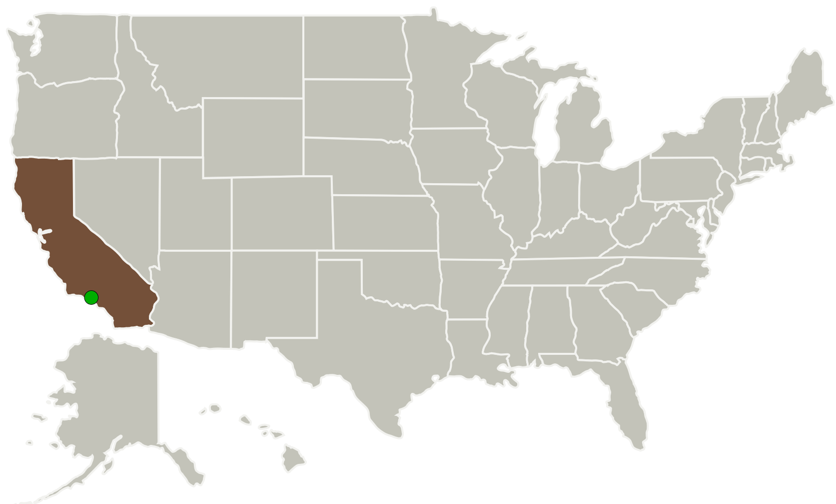
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
RAM Photonics	Lead Organization	Industry	San Diego, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138251)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

RAM Photonics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

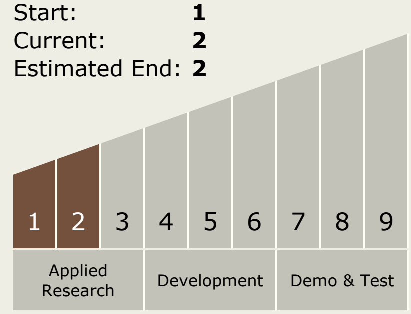
Carlos Torrez

Principal Investigator:

John Marciante

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.1 Optical Communications
    - └ TX05.1.3 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System